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An Experimental Approach to the Functional Analysis of Text Building Behaviour
Part I. The Verbal Flow

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Abstract

This presentation is based on a method for analysing the verbal flow in text building behaviour. This method is called Perspective Text Analysis (PTA). It locates and makes use of the discontinuities in produced text. Its task is to characterise the mechanism that governs language production and to foster an understanding of the actual processes of movement in language. The study of this phenomenon is founded on the experimental conditions provided by the famous Visual Cliff. It is assumed that informational invariants are established through the production of experimental text. Through the behavioural dynamics produced by four experimental subjects, the metrical structure of the co-ordinates of a language space has been established. Furthermore, it is shown that kinetic properties, like velocity and direction, of a verbal flow can be measured and represented by means of a simple regression analysis. Its slope coefficient gives expression to the degree of deviation in the curvature of the measured space. The results of the regression analysis are represented in a log-by-log plot. This plot shows that the verbal flows of the studied systems are characterised by highly similar kinetic properties.

The departure point for the present study is the experimental foundation of text building behaviour. In its functional analysis two levels have been employed. One is related to a verbal flow analysis whose results are reported as Part I in the present paper. The other concerns the information flow, which will be reported in a separate paper as Part II of the experiment. Of particular import for the experimental approach is J. J. Gibson's (1979) theory of ecological perception. Because important aspects of his theory have been demonstrated by means of the famous "Visual Cliff" experiments of E. J. Gibson and R. D. Walk (1960) these experiments constitute the frame of reference for the State of the Art Reports reproduced in the Appendix of the present report. As a consequence, the research question posed is whether and to what degree language in the form of text, describing direct observation, may reflect invariances shown through the analysis of perceptual processing. The physical condition for the study of a language specific pick-up of ecological information is the experimental context provided by the Visual Cliff experiments. Only under this experimental condition can the informational invariants built into the design of the Cliff get their direct counterparts in the production of an experimental text.

An objective frame of reference for studying the physical conditions of an individual's development of perception and action is given in modern field theoretical assumptions. In the present context its broadly based set of hypotheses has been enlarged with the statement that behaviour always is **intentional** and **oriented** toward the transformation of a **field**. Exploration, perception, and incorporation of specific characteristics of one's environment into text generates and preserves one's experience with this environment. Applied to the generation of text, Gibson's law of information implies that ecological invariants manifest themselves in the unique physical context that a particular individual provides by producing a text. Consequently, the dynamic interaction between text and context or between the force of one part of a field with the force of the remaining generates **irreversible** processes.

Method

Subject and Task

The experimental subject may be conceived of as a biological system that is endowed with a generation-regeneration mechanism that has significance for text building. Because writing like locomotion or any other motor activity is dominated by "kinetic" energy flow field properties the ecological hypothesis of text production concerns the supposition that an empty sheet of paper is definable through states that are completely occupied by negative energy and thus nothing on it is observable in "ambient light". Through the act of writing states associated with negative energy become transformed into states coupled with positive energy. Stated very generally, the transformational result manifests itself in the form of graphemes. In its most candid physical sense, a field is a bounded area which is composed of graphemes and spaces in and between strings of graphemes. These constitute the mass (M) of a text. The quantities of graphemes (positive energy) and the separating spaces (negative energy) make up the total amount of energy.

A realisation of potential energy associated with a text producer is the total amount of energy (E) invested into a verbal description. It is an expression of the achieved level of writing activity. In order to study the dissipation of energy over verbal flow patterns, a beginning was made with a Swedish post-doctoral student during her academic year of 1981-1982 at the Department of Linguistics, University of Ottawa, Canada. More specifically, her task was to capture the problem of perceiving a negative affordance in such a way that it could be communicated to an audience unfamiliar with the original Visual Cliff-experiments. For that purpose not only the original article (Gibson & Walk, 1960), but also a number of studies of the emergence of fear on the Cliff were reviewed (e. g. Appel & Campos, 1977; Ball & Tronick, 1971; Bond, 1972; Campos & Krowitz, 1970; Campos, Hiatt, Ramsay, Henderson, & Svejda, 1978; Walk, 1966).

Further, the original Swedish version was translated by her into an English version. This version in turn was reviewed by an English speaking Canadian journalist working at the Department of Communications in Ottawa. He gave some suggestions concerning the wording of the text. His suggestions and re-writings were accepted and given to a French speaking Canadian for translation into a French version. This was achieved at the Translation Department of the Government of Canada. The original Swedish version was also given to a German speaking researcher in the behavioural sciences with extensive knowledge of the theoretical and experimental background of the Visual Cliff. The translation was carried out during his visit in 1981-1982 as Fellow of the Natural Sciences and Engineering Research Council of Canada, Ottawa.

Materials

Under the influence of intentionality, the activities involved in writing, reading and rewriting may be carried out in a more or less elastic way. From a thermodynamical point of view, the experimental subject is expected to produce a text that can be characterised as a **viscous** and **elastic** system. For example, it may happen that a particular subject has made a high investment of energy into the text and thus stretched its mechanical details considerably. Just like invested energy deforms to various degrees the micro regions of body tissues, it should be possible to observe textual signals that communicate to what degree certain micro regions of the texture of a text have been distorted. To deform texture is to stimulate processing by distributing and wrapping lexico-semantic information around certain syntactic functions. This menas that a text producer's contribution of new phrases generates a patterned diffusion of objectives and these constrain in turn his writing-reading-rewriting activities. Evidently text building behaviour contributes to and is constraint by the phrases that build up a texture. Texture provides the necessary link to structure. I. Bierschenk (1992, p. 5) writes: "The fundamental difference between the texture and structure models is not to be found in the basic expression per se, because both a clause and or the combination of a clause into a sentence may project an empirical event, event relation or observation."

That the experimental subjects in addition to their native languages (Swedish, English, French, German) have acquired particular second languages should guarantee that they can understand the import of abstractions produced in one language and translate these into another. It is furthermore expected that they have developed their language mechanisms to a degree of precision that allows the construction of a text that is the result of a transformation of abstractions of environmental observations from one language into another. Even though these mechanisms, when at work, cannot be observed by the text producer himself or by others, they nevertheless work with high precision in the integration and transformation of environmental properties and the production of abstractions. The precision with which these mechanisms are expected to work, precludes any misjudgement of the involved energy potential.

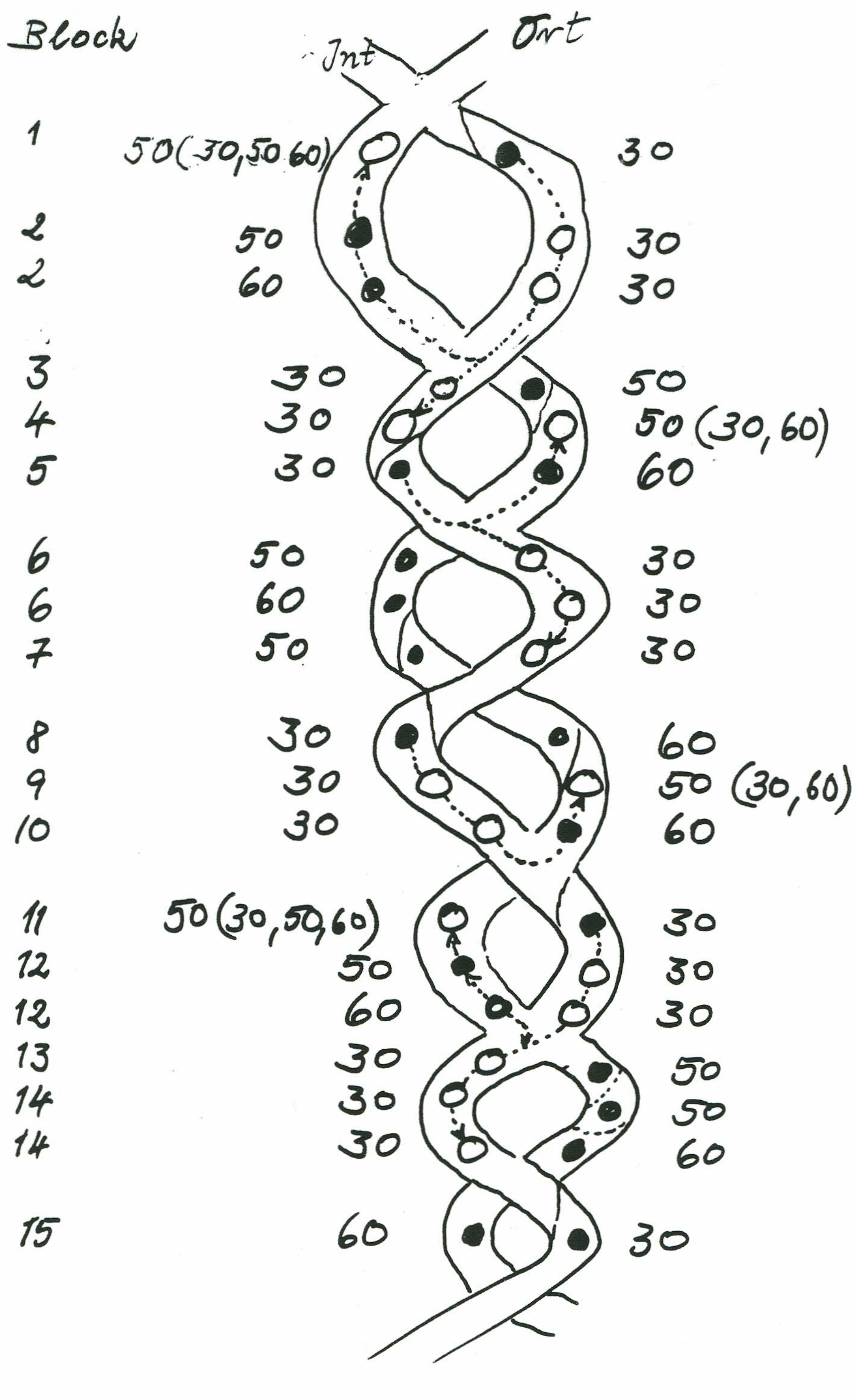
Perceptual processing as well as text processing cannot be studied without an ecological orientation. Making of experience is a matter of an **agent's** (A) inter-**action** (a) with some environmental **objective** (O). Because the perceptual system is involved in the guidance of the haptic system that is responsible for the cyclic behaviour of text building, experience made on the basis of the functions of intention and orientation is in some way or the other incorporated into the text. When text shall be understood by somebody else, his or her sensibility to the properties of the text and the conceived properties of the environment initiate a functional shift from being expression of experience to being context for making experience. This converts text into a "virtual haptic" system which includes its **wholeness**.

Design and Procedure

Transforming intentionality and orientation through motions and movements involved in text building, action and event perception becomes enfolded into text. But this requires the co-operation and interaction between multiple textual agents. The working of these agents comprises a functional coupling manifesting itself as a helix as shown in Figure 1.

Figure 1.

Unfolding the Configurational Architecture of Observed Phase Dependencies



Unfolding the configurational architecture of observed phase dependencies of the couplings implies:

(1) the definition of order parameters that governs the evolutionary process of text building.
(2) the identification of constraints and the breaking of constraints which prescribe the process of assembling the objectives on the basis of the agent-function.
(3) the entering of time in two different ways. In one way it is introduced as a parameter in the definition of a phase as a function of elapsed time. The other introduces time as an organising device which plays an important role in connecting "the direction of time with dynamic processes".
(4) the identification of *twisting* and *twining*. Twining marks a *fold* of the helix. A fold marks the introduction of a new variable. Twisting is instantiated by the existence of substantial strings marking intention and orientation **or** the formal indicator for intention ('it'), marked with an half-filled circle, **and** a substantial string marking the orientation.
(5) Substantial strings are signalled by filled circles and translational properties are indicated by unfilled circles.

Complementary to the helix of the agent-function, an orientation-function is formed. The latter is associated with objectives of a given text. By introducing different agents or by transferring agents from one segment to another, potential energy is dissipated through the objectives embedded in the verbal flow. But the process of dissipating of energy over the objectives introduces a transference of the objectives from one place to another, which initiates a phase-dependent **AaO** coupling. By unfolding the helix of Figure 1 on the basis of an actual text sample it is shown at which points in time new agents are introduced and how they shift throughout the text. The example is taken from the Visual Cliff Reports. The codes of Figure 1 concern the first three sentences in the Swedish version.

The strings of graphemes associated with the codes of Figure 1 are reproduced in Table 1 of the Appendix. By inspecting this Table, it becomes obvious that these strings are hybrid but functionally specific. This implies that work cycles control their discontinuity and changing functions in the verbal flow. By demarcations made through sentence markers and clause markers (see Tab. 2), functionally working clauses are established. Thereby the verb (code 40) acts as functional constant which co-ordinates the agent part (code 30) and objective part (codes 50/60) in the present example. The step indicated by a verb is functionally enclosed and consequently the marker of a functional clause. As soon as a verb has been identified, there is, explicit or not, only one A-variable manifested and at least one O-variable. Strings of graphemes may be present that pertain to different sub-components of the O-component (e. g. Blocks 2, 6, 12, 14). Further, dummies have been substituted with strings of graphemes (e. g. Blocks 2, 6, 9, 13). The clause thus provides the linkage to the language space. It follows that this space is functional and not geometric. It is a marker of elasticity.

By unfolding the functional AaO couplings, it has been discovered (Bierschenk & Bierschenk 1986 a-c) that the language system makes use of the Kantian Schema Axiom as foundation of a inherited **linkage mechanism** (B. Bierschenk, 1991 a, b; 1993 a) that controls the oscillation of its constitutive components. This linkage mechanism has been developed into a system on the basis of the general expression given in B. Bierschenk (1993 a, p. 3) namely:

$(AaO)_n$, where (1)

A-linkage = A_n = Text /X/ A_{n-1}/(A_{n-1}+O_{n-1})

O-linkage = O_n = Text /Y/(A_{n+1}+O_{n+1})

Multiple linkage = ((AaO) a $(AaO)_n$)

/: either
X: variable representing unknown agent
Y: variable representing unknown objective

In general, any string of graphemes or part of these expressions is defined as a conceptualization of an observation if all three constitutive components are present. In principle, an agent dummy (A) is substituted with the immediately preceding agent. If the dummy is language specific (e.g. the string 'it') the immediately preceding block (as defined elsewhere) is the substitute. The object dummy (O) is substituted with the immediately succeeding block. The meaning of this intrasystemic analysis appears only in the Kantian schema as synthesis (B. Bierschenk, 1991 a). The linkage mechanism illustrates how the Schema axiom has been reformulated with respect to the double aspect of time (B. Bierschenk, 1984; 1993) in order to guide and control the development of the (AaO) formula into a dynamic and algorithmic functioning system.

The developed method is called Perspective Text Analysis (PTA). Its task is to characterise the mechanisms that govern the kinetic and kinematic processes in text production and to foster a distinction of the actual processes of motion and movement in language. This distinction is founded on the modern theory of stability and bifurcation (Prigogine, 1980; 1993), which incorporates behavioural dynamics as a particular aspect of time. This theory is concerned with the establishment of temporal morphologies as the other expression of text, namely as evolutionary process. (This second aspect will be made explicit in Part II.) It means in thermodynamic terms that the verbal flow of a text contains a perspective. The perspective introduces the text producer's intention and orientation as **causal control factors** into the design of a scientific processing and analysis of text.

The procedure designed on the basis of PTA consists of a special purpose system of computer programs (PERTEX) which has been developed by Helmersson (1992). It follows that PERTEX provides for the establishment of radically different configurational architectures underlying natural language production, compared to common text processing systems. The concept "system" addresses PERTEX as a unity whose components are: (1) A simple text editor, (2) A text decomposer, (3) A syntactic unit for the assignment of codes to strings of graphemes according to formal logical rules, (4) A unit for supplementation and/or substitution of dummies, (5) A generator of binary matrices, (6) A unit for numerical analysis, (7) A generator for naming the established phase and state attractors.

To summarise, the main features characterising this approach to text processing are: (1) The method operates on the basis of the AaO axiom and works with discontinuities only. This makes the method scientific in the true sense of the notion. (2) The researcher works independent of any need for development or use of normatively constructed schemes of classification. (3) Dynamic and algorithmic working procedures process text of different languages within a PC-system environment. (4) During processing the researcher is freed from making syntactic and semantic judgements. (5) Text is processed with reference to its wholeness, i. e. its teleonomic character. (6) PERTEX works independent of length of text, conceptual depth and grammatical correctness. (7) The system is operational for Swedish and English though prototypes exist for German, French, Norwegian, Danish, Finnish, Italian, and Latin. (8) Numerical analysis is based on the affinity between textual agents and objectives. (9)

Synthesis is formed from natural groupings found in text and stepping upward to the roots of hierarchically presented structures. This transformational procedure provides for the determination of phase and state attractors. (10) By naming the attractors, mental processes and states as well as mental dimensions underlying text production can be reflected.

Results

The classical approach in physics requires that various quantities related to energy such as mass and momentum as well as flows and forces can both be defined and calculated. Feekes (1976) has integrated various hypotheses about different forms of energy into a "periodical system of energies". His model of presentation has been made the foundation of a kinetic description of the verbal flows as expression of energy flows in the produced texts. In order to give a mass-related account of the four texts, these have been stratified according to the following four-fold table:

Table 1.

Stratification of Energy Related Quantities

G	E
S	F

G = German
E = English
S = Swedish
F = French

The invested energy is considered to be the stored energy that a grapheme possesses by virtue of the work that had to be done by the text producer in order to bring it into proper relation and position in the area. A layout of the distribution of energy as conserved in the ensemble of texts shows the following relations:

$M = (G = 5537, E = 4609, S = 4455, F = 5342)$
$\chi^2 = (p_{.99.5} = 7.88 < 165.10)$

The chi-square test discloses that the observed distribution of the text masses is significantly different from the expected. But the intensity with which any of the given constituent grapheme is enforced into its proper position has to be calculated with reference to a unit of time (T). This allows that text masses can be evaluated with reference to periods of production. That mass can be related to time implies that motion underlying text production can be computed as a function of velocity in the production.

The Introduction of a Measure of Length

A **step** in writing like a **step** in locomotion means that the experimental subject produces text that is characterised step by step in the individual's forward moves. The algorithmic stepping through a text is the only possible method to make explicit how the book-keeping procedures make use of the order parameters of PTA. The procedure displays how macroscopic work cycles put together and synchronise the **stepping** performed by the very many micro work cycles involved in the materialisation of an observation.

Of course the magnitude in writing stress determines the viscal-elastic properties of a text. Its significance concerns the embedded activities that exemplify a text as product of a biological system. Such a system contains its own description, because it is self-organising and self-referential. On the observational level, however, distance relationships between the A's and

O's do not always get their manifestation, because the observer may choose not to make explicit the full **scope of action**.

The scope of action denotes a determination of the points of departure applied on the observations of events. This scope is decided upon by the empirical context. Its physical conditions depend on the production of a verbal flow. This flow is always intentionally produced and necessarily comprises an orientation which means that the flow becomes directed. During production numerous periods and fractions within periods help to differentiate and organise the pace with which objectives become embedded in the flow.

By demarcating strings of graphemes through markers of periods as well as markers of fractions of periods, functional working clauses become established. Within the demarcated **arrays** the AaO mechanism makes explicit the strict dependency that exists between the strings of graphemes and the disposal of textual elements. The mechanism provides the foundation for a novel design of a measure of length. Its central properties are characterised by the complementary roles that can be performed by the A- and O-components respectively:

(1) governed by clause openers, an iterative procedure interchanges strings of graphemes.
(2) dummies for agents (A) and objectives (O) are substituted with strings of graphemes.
(3) the dummies for agents are processed by a forward or downward swing.
(4) the dummies for objectives are processed by a backward or upward swing.
(5) pendular down- and upward swings perform according to "limit cycles".
(6) the "limit cycle" mode controls the discontinuities and changes in the verbal flow.
(7) clock-like cyclic and recursive algorithmic procedures establish a dynamic regime.

By specifying a point of suspension for the pendulum that moves **periodically** and **swings** discursively and recursively, the pendulum becomes defined by a path into chaos which means that the relationship between its Eigen-dynamics (T_0) and (T) advance into the description of a spherical surface, like that of a football. This means that the length of a text cannot be equated with a flat surface or **texture**. In the course of writing the text producer continually contributes with new agent-objective couplings and the breaking of couplings. This process portrays the structural co-ordination underlying text production. Writing is a process similar to growing of tissue or texture. Both have some kind of organisational coherence. The physical development of the texture of a text into segments can be observed as extension over time. These segments may be called developmental fields. Each field is of a certain length, because it consists of a variable number of AaO's. For metrical purposes the AaO's have been renamed into **Blocks**.

Choosing the linear dimension (L) makes the relational dimensionality of the Blocks obvious. This dimension will increase in power as text grows. Successive larger values of measures taken on text volume and text surface (texture) will show that the growth rates of volume and texture are not identical. Volume grows more rapidly with increase in the linear dimension compared to the expansion of text surface. The relational interactions of the Blocks is three-dimensional. This can be visualised as shown in Figure 2, which indicates in what way the the kinetic couplings can be visualised as three lines (3L!) going in different directions. The common expression for its section modulus is the volume (V):

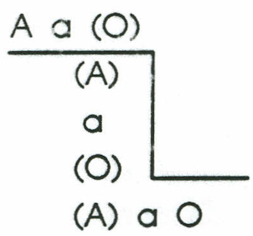
$$L^3 \Rightarrow V \tag{2}$$

The coupling of an (A) with an (O) will always be two-dimensional and thus equivalent to a surface (S). The common expression for its greatest section on the axis is:

$$L^2 \Rightarrow S \tag{3}$$

Figure 2.

Graphical Representation of AaO Couplings



Of the forces determining the form of text, some will be in proportion to S, i. e. the greatest section of texture of a textual surface and others will be in balance with V, i.e. the volume of a text. Clearly, the extension or expansion of a text is an expression of the work (w_{visc}) that has been invested by the text producer:

$$(L^2\,L^3) \Rightarrow w_{visc} \qquad (4)$$

This expression is related to the observation that distortions alter the regular form of the work cycles in a fashion that allows the textual surface keeping pace with its underlying structure. The energy source involved in writing gets its logical outflow through the motor cortex, which means that "verbal flow" (vf) is the result of a single integration of the steps taken in a work cycle:

$$(L^2\,L^3\,T^{-1}) \Rightarrow vf \qquad (5)$$

But the pressure potential (PP) involved in "displacement of textual elements" is established by a double integration, i. e. an integration of the work cycles:

$$(ML^{-3}T^{-2}) \Rightarrow PP \qquad (6)$$

This implies that the pendular clocking mode dominates the act of writing in that it produces dislocations within limits. Typically for a scientific text of the produced type is the way in which the relationship between various points of observation are specified. To paraphrase Kuger and Turvey (1982, p. 159), this kind of relations need to co-operate with the kinetic flow patterns that lawfully generate the kinematic flow patterns which in turn specify the kinetic properties of that flow. The achieved adaptations always produce some kind of distortion of the texture in order to allow the producer to put himself successively into the position of the observer or into a position on the action level. These distortions are needed for an appropriate representation of events that invariably begin and end abruptly. This implies that events on the textual level are perceivable only to the degree that **discontinuity** can be observed. A text example taken from the Visual Cliff Reports (see Table 2) may be illustrative of locating and making use of these discontinuities.

Lexicon coding. **Five basic parameters** govern the assignments of numerical codes to the strings of graphemes of Table 2. This the most fundamental step in the differential processing of the text samples. The first of these basic parameters is the **period**. The full pause at the end of a pattern of strings of graphemes, or graphemes like (. ? !) at the end of a certain pattern are taken as indicators of a period or unit time. The second basic parameter concern

the idenification of **fractions** within periods like (, : ; as well as 'and', 'as', 'if'). Basically, some very small dictionaries containing the sentence openers as well as the clause openers are used by a procedure that identifies and marks periods with code (00) and the fractions with code (01). Consequently, the verbal flow can be associated with structuring at the kinetic level of text production. Therefore, it is of some interest to demonstrate to what degree the expected number of periods characterising a particular text is similar to any other. The following distribution has been observed:

T = (G = 42, E = 42, S = 41, F = 41).
$\chi^2 = .000$

By examining the observed frequencies on the basis of the introduced chi-square function it can be concluded that no unexpected deviations are demonstrable. This is a result that stands in fundamental agreement with previously reported studies (see B. Bierschenk, 1992), that is with the **internal timing** of high and low achievers.

Because the clause markers are basic to the identification of fractions within the periodicity of text building behaviour, their frequency distribution has also been tested:

t = (G = 89, E = 64, S = 54, F = 48)
$\chi^2 = (p_{.50} = .016 < \ .67 < p_{.60} = 2.71)$

The test shows that no noticeable deviations from the expected distribution have been observed.

The third basic parameter is a functional constant, namely the verb. Only the verbs marked with code (40) are numerous. A verb is defined as a single string of graphemes in its finite or infinite form. By this definition semantic meaning is cancelled, which means that it has no relevance, nor has intransitivity. Finally, special rules for English short forms like ('it's' and 'I'm') are transformed into common form ('it is' and 'I am'). French contractions like ('d'exposer' and 's'attendaient') are separated.

Note: In the G-system an intermediate step between lexicon coding and Block coding instantiates procedures which move the 40-codes from a final position in a subordinate clause to a position immediately after the clause opener. This measure is taken because of the famous "Verbklammer" in German, which controls the perspective in reporting observations. The sentence from which the Blocks of Table 2 have been extracted is an example of this fundamental German language function. The Block beginning with ('Als ob') implies that the perspective is observed to be "as if" it were that of the observer, that is, the position vis-à-vis the observed is the same although the distance is different.

The forth basic paramenter addresses the pointers to the objective component. A small dictionary contains the pointers to the objective components, like 'with' marked by the code (70). Finally the fifth parameter is associated with the A- and O-dummies, i.e. absence of an A- or O-variable, respectively.

Block coding. As soon as a verb has been identified and accentuated by clause openers, it becomes possible to decide algorithmically whether or not an A-variable is present and if at least one O-variable is manifest. Further, if three or more clause openers constitute a sequence, a procedure is initiated that computes and marks a technical sentence border. It changes the code of the first clause opener into code (00) and couples all others by an underscore (e. g. as_if). Concerning the other codes it may be noted that the blocks (2, 3) in the E-system contain both an A-dummy and an O-dummy which has been assigned the code (50). The presence or absence of a variable associated with this particular sub-component of the objective is identified on the basis of the absence of any particular type of pointers.

Table 2.

The AaO-machine as Book-keeping Mechanism for Quantitative Description of the Kinetic System States

System	Lexicon Coding	*Block Coding*	*Supplementation*
S-system	01 ,	00 ,	00 ,
	01 som	01 som_om	01 som_om
	01 om	30 de	30 de
	de	40 förvantade	40 förväntade
	40 förväntade	50 sig	50 sig
	sig	01 att	01 att
	01 att	30 A-dummy	30 de
	40 ta	40 ta	40 ta
	mark	50 mark	50 mark
	01 ,	01 ,	01 ,
E-system	01 as	01 as_if	01 as_if
	01 if	30 they	30 they
	they	40 were	40 were
	40 were	50 O-dummy	50 they not over the deep
			side
	40 expecting	01 *	
	01 to	30 A-dummy	30 they
	40 land	40 expecting	40 expecting
	01 ,	50 O-dummy	50 they not over the deep
			side
		01 to	01 to
		30 A-dummy	30 they
		40 land	40 land
		50 O-dummy	50 they not over the deep
			side
		01 ,	
F-system	01 comme	01 comme_si	01 comme_si
	01 si	30 ils	30 ils s'
	ils	30 s'	40 attentaient
	s'	40 attendaient	50 ils s' contact avec le
			sol
	40 attendaient	50 O-dummy	01 à
	01 à	01 à	30 ils s'
	40 prendre	30 A-dummy	40 prendre
	contact	40 prendre	50 contact
	70 avec	50 contact	70 avec le sol
	le	70 avec	01 ,
	sol	70 le	
	01 ,	70 sol	
		01 ,	
G-system	01 ,	00 ,	00 ,
	01 als	01 als_ob	01 als_ob
	01 ob	30 sie	30 sie
	sie	40 erwarteten	40 erwarteten
	40 erwarteten	50 O-dummy	50 sie sich
	01 ,	01 ,	01 ,
	40 setzen	30 A-dummy	30 sie
	40 zu_können	40 setzen	40 setzen
	sich	50 O-dummy	50 sie sich
	01 ,	01 *	01 ,
		30 A-dummy	30 sie
		40 zu_können	40 zu_können
		50 sich	50 sich
		01 ,	01 ,

This means that the verb 'expecting' and the verb 'land' act as functional constants that co-ordinate the co-operation of as yet departing agents and objectives. A central property of the Block coding is the procedure that automatically marks the agents and objectives by assigning them their proper codes. In Table 2 all identified objectives have been assigned the code (50) though with an exception in the F-system, where an additional code (70) is present. Measured over the entire text and all types of identified objectives (50, 60, 70, 80), the distribution is the following:

$B = (G = 144, E = 161, S = 169, F = 183)$
$\chi^2 = (p_{.05} = .004 < .042 < p_{.10} = .016)$

No significant deviations can be concluded. The embedding of the observations into Blocks is not different from what could be expected under the zero hypothesis. Thus far one's conceptualisations expressed in the forming and de-forming of a particular text, show no significant deviations in the characterisation of the kinetics of the four textual systems.

Supplementation. Governed by the clause openers, an iterative procedure substitutes and interchanges strings of graphemes. The aim of substitution by supplementation is to provide the basis for an information synthesis. Because of the linear functioning of the AaO mechanism, this wholeness of a text manifests itself as wholeness of texture. As the text moves on, the distortions become identified during the Block coding phase. On the textual surface they function as "peep-holes" (I. Bierschenk, 1992 a, b) into the structure. These peep-holes are filled with textual material during the supplementation phase.

The E-system illustrates how the A-dummies are processed by a forward or downward swing of the pendulum that carries the agent string ('they') from the first Block to the second and third Block where the A-dummies are substituted with ('they').
Considered over the entire text, the distribution of the A-dummies is the following:

$(A) = (G = 108, E = 108, S = 118, F = 123)$
$\chi^2 = (p_{.05} = .004 < .049 < p_{.10} = .016)$

Because of the insignificant chi-square it can be concluded that the distribution of the values of this basic parameter is not different from what can be expected.

With respect to the O-dummies the angle of the backward or upward swing is even wider. It carries the A-variable ('they') as well as a 60-coded and negated objective into the place held by a 50-dummy in the third Block ('they not over the deep side') and further upward into the second and first Block respectively. A check on the entire distribution of O-dummies shows the following:

$(O) = (G = 35, E = 63, S = 46, F = 81)$
$\chi^2 = (p_{.02.5} = .00098 < .006 < p_{.05} = .004)$

Even in this case is the chi-square value indicative of no significant deviation of what could be expected with respect to the O-component. This means that pendular downward and upward swings perform equally according to the work cycles which control the discontinuities and changes in the verbal flow. It follows that the clock-like and cyclic working supplementation procedure has established a dynamic regime with no significant deviations from the expected distribution of the basic parameter values.

Rhythmic Pendular Down- and Upward Moves

A block provides the local field of textual growth and consequently a precise definition of the length of a step. Each block contributes to the dissipation of potential energy and preserves within it a quantity or magnitude that is defined on the cycle. But the values of the stepping function can fluctuate as indicated by the excursion in the E-system. Locally seen this system has the greatest length as indicated by the distance between the A and the O. This means that the physical growth of a system is bound to a mechanical elevation of the variable of the O-component up to a point where its affinity relation to the A-component can be observed directly.

Thus the expansion over fractions and periods fluctuates. Spacing textual elements are shown to be determined by local syntactic stretching conditions. A one step excursion in the S-system is sufficient for making the agent distinct. All other systems require several steps in order to reach a steady state condition. It is evident from inspection of Table 2 that the single angular excursion is directly related to length or stepping. But the overall fluctuation has not affected the total length of the individual texts. Because Blocks and periods are mutually dependent, it is possible to manipulate the mass-length relationship by changing the mechanical properties of the system. The syntactic properties governing its pendular (i.e. angular) excursion changes the magnitude in the mass-length relation. In ordering the systems, the Blocks of a text have priority over the text mass. According to the mass conditions, the direction in the order-relation (G < F < E < S) indicates that the systems are not equal, but more importantly to the present discussion is the fact that these systems are equivalent with respect to expected length. Thus the magnitude of length throughout the blocks can change locally, but the overall fluctuation need not affect the qualitative stability of text, because quality does not develop exponentially with expanding text mass.

As demonstrated by the given examples in Table 2 angular excursion is associated with varying length, but different length conditions provide for the establishment of individual variations in the style of textual movement. A style gives expression to each text producer's own idiosyncratic distortions of the basic pattern of the otherwise perfectly regular rhythm of a period. Irregular periods and distortions of the basic pattern imply that the A's and O's of the blocks can be combined at different phases in a cycle that may vary in various ways, by being smooth or inelastic and dynamic or concentrated. The rhythm in text building behaviour may be as varied as any other biological rhythm.

A physical analysis of the patterns shown in Table 2 demonstrates that the degree of their elasticity varies. This means that the surface of any particular system is more or less dynamic. The E-system, for example, makes explicit substantial displacements when these are related to the agent's point of observation. An inspection of the operational A-component shows that the local discursive downward move is initiated by the verb ('were') and continued through the verb ('expecting') and the verb ('land'). This results in a local disturbance that terminates first at the brink of the actual sentence. Because the objective ('not over the deep side') is approached at a brink of the textual surface, a recursive move of the O-component elevates the agent in the Block at that brink together with its objective up to the point from where the displacement originated. These variables are jointly reproduced repeated times. The thermodynamic property of these upward moves over the Blocks (B) can be expressed by (dB/dt). But the units involved in the variable (B) are cancelled, because non-distinctness is indicated by the identity of their strings of graphemes which gives the dimension (1/1) or (T^{-1}) (see Kugler & Turvey, 1982, p. 102). These authors have calculated this macroscopic characteristic for muscle/tendon "tissue-flow" patterns.

The pendular clocking mode of down- and upward moves may encompass and organise variables of more than one sub-component of the objective. In the F-system both a 50- and a 70-coded string of graphemes are assembled and jointly elevated, because both are in the perspective of the agent at the verb ('attendaient'). In the event of supplementation these strings are determined by local conditions. From this same perspective it can be concluded that

the degree of displacement indexed in Table 2 is greater in the F-system than in any other of the four systems. Thus the operational downward move of the A-component and the upward move of the O-component restricts the degrading of the flow. As will be shown (see Part II. The Information Flow), the restrictions result in flow oscillations between well defined minima and maxima within the established state spaces.

A Strictly Quantitative Description of the Viscal-Elasticity-Relation

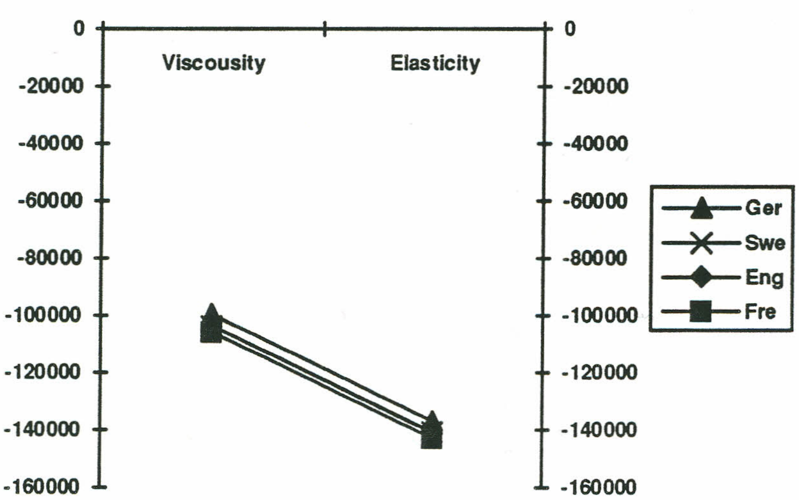
The purpose of this description is to derive the order of the scaling relation between "Pressure in Processing" and "Action Potential", i. e. between expressions (6) and (7). Understanding the kinetic nature of the verbal flow in naturally produced text involves interaction with almost all of its parts and all of its textured surface. This circumstance needs to be focused upon, since the primary aspect of these interactions is to define the process of information pick-up. Putting pressure on various parts of the texture of a text is to enforce its processing. Therefore, text building suggests that microscopic distortions are aggregated and represented by the scope of action. This scope can be extended or prolonged which defines the dimensionality of a text on the basis of nested dependencies. An observation on the Cliff always gives expression to only one action but the points of observation may be several. This means that the three components of the AaO-formula can be used to represent the action potential (AP):

$$(ML^{-3}\,T^{-1}) \Rightarrow AP \qquad (7)$$

Because the level of writing activity defines the self-organising capacity of text as a system, it is possible to demonstrate that Feekes (1976) expression for energy investment is useful in giving a general account of the degree of viscousity in a text. The main point to be emphasised is that its degree of organised complexity or form determines the nature of the information carried by a verbal flow. In agreement with this line of argumentation, for the ensemble of texts, the kind of data points illustrated in Figure 1 have been mapped into the double logarithmic co-ordinates of the space shown in Figure (3).

Figure 3.

The Decomposed Linear Relations between the Action Potential and Pressure in Processing



Moreover, text building may be conceived of as an intentional remodelling of a form which transforms both size and configuration of a text. Therefore text building can be conceived of as a viscal-elastic event as defined over the architectural configuration of the double helix of Figure 1. The **viscal** component of this event is associated with the **structural** aspect of the AaO-formula. To characterise completely the forces put on individual textual elements requires that the strain and the sheer imposed upon parts of the texture by stress can be measured.

Two observations can be made concerning the scaling and its structural stability: (1) the moment variable, i. e. the stress forces working upon the Action Potential and the pressure variable, i. e. the forces influencing text processing, are perfectly correlated, and (2) the slope of their curvature is very close to unity.

Table (3) gives the regression analysis performed on the data reproduced in Figure (3), as well as the proportion of variance accounted for and the ANOVA. As indicated by the slope coefficient, a first order relationship exists between both variables. Moreover, the constant by which the variables differ for all values marks the intercept. Goodness-of-fit estimates show a nearly perfect relation between the parameter estimates and the data set.

Table 3.

Regression of Pressure in Processing on Action Potential

Predictor	Coef	Stdev	t-ratio	p	
Constant	4.232	0.408	10.37	0.009	
Pressure	1.036	0.029	35.63	0.001	
s = 0.01281	R^2 = 99.8%	R^2 (adj) = 99.8%			
ANOVA					
Source	DF	SS	MS	F	p
Regression	1	0.208	0.208	1269.73	0.001
Error	2	0.000	0.000		
Total	3	0.208			

However, the systems differ slightly with respect to the way in which the forces have either stretched or compressed the flow structures. This is due to intentionality associated with the agent factor. The agent who has produced the S- and E-system is one and the same which resulted in highly similar styles of text building behaviour. The editorial contribution of the Canadian journalist has introduced some but indistinguishable deviations concerning the elasticity. The agents that have produced the G-and the F-system have worked independent of each other as well as independent of the agent of the original Swedish/English version. Because of this circumstance just noticeable deviations can be observed, pointing toward somewhat greater differences in their inclinations.

A potential of action put in relation to the pressure in the flow specifies the degree of fluidness in the diffusion of the objectives over the flow fields. Thus the **elasticity** component is associated with the **functional** aspect of the AaO-formula and its emphasis is on the pressure ("sheer") upon the constituents of the AaO-formula. However, the overall impression is that all systems seem to oscillate in highly similar ways. It follows that the variation in their fabric modes points toward great similarity in the properties of their kinematic (information) flow fields. It is expected that the established similarity should show up in a corresponding degree of stability at the kinematic level and thus the description of the information flow gradients and the singularities of these gradients.

Discussion

Against the stratificational background of Table 1, the most concentrated or crystallised behavioural style (+ +) seems to characterise the G-system while the behavioural style of the F-system seems to be demarcated by being the most relaxed (- -). The textual fabric wrought by the two kinetic sources seems in the E-system to be slightly more fluid (+ -) compared to the S-system (- +). With respect to the strain operating on the **viscal** component of the G- and F-system respectively, they are each others opposite. Clearly, straining indicates a transformational effect. It may be argued that this effect points toward differences in the growth event. These differences may be conceived of as the result of some deviations in the *Action Potentials* whose stress forces have different values at different points in certain micro regions of the verbal flow fields.

Further, contrasting the locally originating textual flows in the F-system with the flows in the G-system indicates that the kinetic sources may have given rise to properties that are even more specific to the tendencies in the flows. This conclusion appears to be plausible, since a major transformational re-working must have taken place under considerable straining. The flow in the G-system indicates a certain degree of time-varying distortion across the developmental fields that points toward greater stress. This may depend on both the location of the lexico-semantic elements of the single constituents as well as on their orientation (angle) to the axes of the double helix of Figure 1. In some cases this kind of distortions may point toward considerable instability at the thermodynamic level of an ensemble of texts (see e.g. B. Bierschenk, 1992). But in the present study all measures point toward high stability in the text building behaviour of the producers of the Visual Cliff Reports. This may be conceived of as a profound insight into the physical mechanism of energy conservation, especially when coupled to a geometrical representation of the "biological time" (Winfree, 1980) that seems to govern text building behaviour.

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Appendix

The Original Swedish Version of the Visual Cliff Report generated by a Humanist

Många föräldrar, som noga har observerat sina småbarn i krypåldern, har antagligen märkt, att dessa i början kryper över kanter av olika slag utan att vara medvetna om risken att falla. En grupp forskare, intresserad av utvecklingen hos barn, har utforskat i detalj beteendet hos småbarn i dessa situationer. Forskarnas målsättning var att få en bättre förståelse av utvecklingen av framsteg hos småbarn, när det gäller deras förmåga att behärska kroppen och av den roll som utvecklingen av synen spelar i denna process. Dessutom hoppades de få grepp om utvecklingen av bedömningsförmågan hos småbarn i relation till problemet att koordinera syn och kroppsrörelse. Slutligen ville de veta på vilka sinnen det lilla barnet förlitar sig mest.

Eftersom det skulle ha varit oetiskt att utsätta småbarn för verkliga risksituationer av det slag som kan finnas i ett hem till exempel, behövde forskarna bygga upp en experimentell omgivning som skulle simulera upplevelsen av ett fall för ett litet barn. Föreställ Dig således en anordning som har en glasskiva och som ser ut som ett 1.80x1.40m stort bord. Anordningen, som är ca 1m hög, har en 20cm hög kant, för att hindra det lilla barnet från att falla av, medan glasskivan har tvådelats genom en mittbräda. Under ena halvan av glasskivan har ett stycke tyg, som har 0.5cm stora rutor, fästs direkt mot undersidan av glaset. Rutorna ger ett utseende av fasthet eller substans åt glasytan. Denna sida kallas därför den grunda sidan. Under den andra halvan av glasskivan har ett stycke av samma tyg, som nu har 7cm stora rutor, lagts på golvet, 1m nedanför glasskivan. Denna sida, som ger intrycket av djup, kallas den djupa sidan. För att minska oregelbundenheter i det lilla barnets varseblivning av de två ytorna, har den djupa sidan inhägnats och lampor har monterats under mittbrädan, för att utjämna ljusskillnaderna hos de båda sidorna.

I undersökningen inbjöds mödrar att deltaga med sina småbarn i ett antal aktiviteter som skapades på bordsskivan. Under årens lopp har gruppen lyckats undersöka beteendet hos över 600 småbarn, vilkas ålder varierade mellan två och fjorton månader. Med hjälp av observationer bildades tre grupper av småbarn: barn mellan två och fyra månader, barn mellan fem och nio månader och barn mellan tio och fjorton månader i genomsnitt. Genom att observera dessa grupper kunde forskarna urskilja skilda beteenden. För att börja med den yngsta gruppen, så lade forskarna märke till, att när dessa småbarn placerades omväxlande över den grunda eller den djupa sidan, uttryckte de varseblivning av de olika situationerna genom fysiska reaktioner. Då dessa småbarn var för små att krypa, sänkte en person dem långsamt ner till en punkt strax ovanför glasytan på de båda sidorna. När de befann sig nära ytan av den grunda sidan, sträckte de typiskt ut ben och fingrar, som om de förväntade sig att ta mark, vilket inte hände över den djupa sidan. När de istället sattes direkt på ytan av endera sidan, tittade de ner mer uppmärksamt över den djupa sidan än över den grunda. Därutöver noterade forskarna, att de här riktigt små småbarnen inte grät, när de sattes på ytan av den djupa sidan och att inte heller deras hjärtslag skilde sig åt från sida till sida.

Småbarn som uppnått en tidig krypålder, fem till nio månader, använde sig av olika strategier för att förflytta sig, fastän de måste lockas av sina mödrar. Varje småbarn sattes på mittbrädan och därefter kallade barnets mamma på det successivt från den djupa och grunda sidan. När de närmade sig sina mammor från den grunda sidan, backade många ut över till den djupa halvan och skulle ha fallit, om inte glaset varit. Inom denna grupp var det många småbarn som vände sig bort från sin mamma, när hon kallade från den djupa sidan, medan andra grät. Ganska många kröp diagonalt, när de tog sig över den djupa sidan. Somliga ville också klappa glaset eller slicka det. Men trots att de kände glaset, vägrade de ta sig över den djupa sidan.

Tydligen uppfattade denna åldersgrupp skillnaden mellan de två sidorna, även om mindre än hälften av gruppen kunde bedöma konsekvenserna. Småbarnen i sent utvecklad krypålder tenderade att ändra sitt sätt att ta sig över den djupa sidan. För att nå sin mamma,

försökte de följa sidorna av kanten. Genom att låta dem göra sina försök flera gånger kunde forskarna tydligt observera att småbarnen gjorde bedömningar och att ca 80 procent ändrade sitt beteende, för att undgå risken att falla. När de äldre småbarnen sattes på ytan av den djupa sidan, hade de snabbare hjärtslag där än över den grunda sidan.

Tydligen har småbarns beteende mycket gemensamt trots olika ålder. Lika tydligt är att småbarn i samma ålder beter sig olika i vissa avseenden. För forskarna står det klart, att synen utvecklas mycket tidigt, vilket betyder att de flesta småbarn, trots stora åldersskillnader, känner igen signaler till sådana ställen där de skulle kunna falla. Å andra sidan är det lika tydligt, att deras förmåga att förflytta sig och att bedöma konsekvenserna av sina förflyttningar skiljer sig markant i samma ålder. Det är påtagligt, att det är ögonen som småbarn först och främst litar till i nya och förvirrande situationer och det är inte förrän de lär sig att bedöma konsekvenserna, som innebörden i en tvär brant blir uppenbar för dem. Vidare studier av denna process skulle kunna leda till hjälpmedel, som minskar att småbarn utsätts för fara när de börjar utforska sin hemmiljö.

The Original Version Re-worked by a Canadian Journalist

Many parents, who have carefully observed their infants at the crawling stage, may have observed that, initially, they crawl over edges of different kinds without being aware of the danger of falling. A group of researchers interested in the development of children, has explored in detail the behaviour of infants in these situations. The researchers' goal was to gain a better understanding of the development of progress in infants concerning their ability to move their bodies, and the role that the development of sight may play in this process. Moreover, they hoped to get a grasp of the development of judgement in infants in relation to the problem of co-ordinating sight and body movement. Finally, they wanted to find out on which senses the infant relies the most.

Since it would be unethical to expose infants to naturally dangerous situations, such as are to be found in a home, for example, the researchers had to device an experimental environment that would simulate for the infant the experience of falling. Hence, imagine a device that looks like a large six-by-eight-foot glass-topped table. The device, forty inches high, has an eight-inch high border to keep the infant from falling off, while the glass-top has been divided into two by a centre board. Under one half of the glass-top a sheet of material having a one-quarter-inch checked pattern has been placed flush against the undersurface of the glass. The pattern gives the appearance of solidity or substance to the glass surface. Therefore, this side is called the shallow side. Under the other half of the glass-top a sheet of the same material, now having a three-inched checked pattern, has been laid upon the floor forty inches below the glass-top. This side, which gives the impression of depth, is called the deep side. To reduce anomalies in the infant's awareness of the two surfaces the deep side has been enclosed, and lights have been mounted under the centre board to equalise the illumination on both surfaces.

In the experiment, mothers were invited to participate with their infants in a number of activities, which were created on the table top. Over the years, the group has been able to investigate the behaviour of more than 600 infants, whose age varied between two and fourteen months. By means of observations three groups of infants were formed: infants between two and four months, infants between five and nine months, and infants between ten and fourteen months, on the average. Several observations were made. By observing these groups the researchers could discern various behaviour. To start with the youngest group, the researchers noticed that when these infants were placed alternatively over the shallow or the deep side, they expressed an awareness of the different situations through physical reactions. Because these infants were too young to crawl, the researchers slowly lowered them down to a point just above the glass surface of both sides. When they came close to the surface of the shallow side, typically they extended their legs and fingers as if they were expecting to land, which did not happen over the deep side. When, instead, they were seated directly on the

surface of either side, they looked down more attentively over the deep than over the shallow one. Moreover, the researchers noted that these very young infants did not cry when seated on the surface of the deep side, nor did their heart-beats differ from side to side.

Infants who had reached an early crawling age, five to nine months, made use of different strategies of moving about, although they had to be lured into action by their mothers. Each infant was seated on the centre board, and thereafter its mother called it from the deep and shallow side successively. When they neared their mothers from the shallow side, several backed out over to the deep half and would have fallen, were it not for the glass. Within this group, many infants turned away from their mother when she called from the deep side, while others cried. Quite a few crawled diagonally when crossing the deep side. Some would also pat the glass or lick it. Yet, despite feeling the presence of the glass, they refused to cross the deep side. Obviously, this age group was aware of the difference of the two sides, although less than half of the group was able to judge the consequences.

The late-maturing crawlers tended to change their way of crossing the deep side. To reach their mother, they tried to follow the sides of the border. By letting them make their way several times, the researchers were able to observe clearly that the infants made judgements, and that about eighty percent redirected their behaviour to circumvent the risk of falling. The older infants seated on the surface of the deep side, had faster heart-beats there than over the shallow side. Obviously, infants' behaviour has much in common, despite differences in age. Just as clearly, infants of the same age behave differently in certain respects.

For the researchers it is evident that sight develops very early, which means that most infants, despite great age differences, recognise clues to places where they might fall. On the other hand, it is equally evident that their ability to move about and to judge consequences of their movements differ markedly. Apparently, infants firstly rely on their eyes in new and confusing situations, and it is not until they can move about and learn to judge consequences that the meaning of a sharp drop becomes obvious for them. Further studies of this process may lead to means of minimising infants' exposure to danger when they begin to explore their home environment.

The Re-worked English Version Translated by a Professional

De nombreux parents, qui ont observé attentivement leurs petits se trouvant au moment de se traîner, ont peut-être remarqué qu'au début ils rampent par-dessus des points de chute de tous genres sans être conscients des risques de tomber.

Un groupe de chercheurs interessé au développement de l'enfant, ont étudié en détail le comportement des petits enfants. Le but des chercheurs était de mieux comprendre le développement des progrès chez les petits en ce qui concerne leur aptitude à mouvoir leur corps ainsi que le rôle que joue le développement de la vue dans ce processus.

Ils espéraient en outre saisir le développement du jugement chez les petits en relation avec la coordination de la vue et des movements corporels. Enfin ils voulaient découvrir quel est le sens sur lequel le petit enfant compte le plus.

Puisqu'il aurait été contraire à l'ethique professionnelle d'exposer des petits à de véritables dangers comme ceux qui peuvent être trouvés dans une maison par example, les chercheurs ont dû créer un milieu experimental, qui permettrait de simuler pour un petit enfant une expérience de chute.

Imaginez vous donc un dispositif, qui a une plaque de verre et qui ressemble à une grande table de six pieds sur huit. Le dispositif d'une hauteur de quarante pouces a une bordure de huit pouces de hauteur destinée a empêcher le petit de débouler pendant que la plaque de verre a eté divisée en deux par une planchette centrale. Sous une première moitié de la plaque de verre une pièce de tissu, ayant un motif a carreaux d'un demi-pouce, a été adossé directement contre la face intérieure de la plaque de verre. Le motif donne à la surface de verre une apparition de solidité ou de consistence. Par conséquent, partie de la table s'est appelée côté peu profond. Sous l'autre moitié de la plaque de verre une pièce du même tissu, ayant

cette fois un motif à carreux de trois pouces, a été placée sur le plancher à quarante pouces du dessous de la plaque de verre. Cette partie de la table, qui donne une impression de profondeur s' est appelée côté profond. Afin de réduire chez le petit des anomalies dans sa perception des deux surfaces, le côté profond a été enclos et des lumières ont été disposées sous la planchette centrale pour égaliser illumination des deux surfaces.

Dans l'expérience, des mères étaient invitées a participer avec leurs petits à un nombre d'activités,qui étaient creés sur la plaque de la table. Au cours des années, le groupe a été en état d'examiner le comportement de plus de 600 petits, dont l'âge a varié entre deux et quatorze mois. Par le moyen de l'oberservation, trois groupes de petits ont été repartis: ceux de deux á quatre mois, ceux de cinq á neuf mois et ceux de dix á quatorze mois en moyenne.

En observant ces groupes, les chercheurs out pu discerner des comportements de plusieurs sortes. D'abord dans le groupe des plus jeunes les chercheurs ont remarqué que lorsque les petits etaient placés en alternance au-dessus du côté peu profond et du côté profond, ils manifestaient par des reactions physiques une prise de conscience des situations différentes. Comme ces petits étaient trop jeunes pour ramper, une personne les abaissait lentement jusqu'à un point juste au-dessus de la surface de verre des deux parties de la table. Quand les petits étaient proche de la surface du côté peu profond, typiquement ils étendaient leurs doigts et leurs jambes comme s' ils s'attendaient à prendre contact avec le sol, ce qui ne se passait pas au-dessus du côté profond.

Au lieu de celà, lorsqu'ils étaient assis directement sur la surface d'un côté comme de l'autre, ils regardaient plus attentivement vers le bas au-dessus du côté profond qu'au-dessus du côté peu profond. D'ailleurs les chercheurs ont noté, que les très jeunes petits assis sur la surface du côté profond ne pleuraient pas et que leur rythme cardiaque ne différait pas d'un côté à l'autre. Les petits de cinq à neuf mois, qui avaient atteint un tout jeune âge de se traîner s'en servaient des strategies différentes de se déplacer, bien qu' ils ont dû être entraînés en action par leurs mères.

Chaque petit était assis sur la planchette centrale et puis sa mère appelait tour à tour du côté profond et du côté peu profond. Alors que les petits approchaient de leurs mères du côté peu profond, plusieurs ont reculé au-dessus de la moitié profonde et auraient tombé. Dans ce groupe bon nombre des petits se détournaient de leur mére, lorsqu'elle appelait du côté profond. Alors que d'autres pleuraient. Un bon nombre d'entre eux ont rampé en diagonale pendant qu'ils traversaient le côté profond. Certaines des petits voulaient aussi caresser le verre ou cependant, même s' ils sentaient la présence du verre, ils se sont refusé de traverser le côté profond.

Il est évident que ce groupe d'âge avaient conscience des différences entre les deux côtés, bien que moins de la moitié était en mesure d' en juger les consequences. Les petits d'un âge tard de se traîner ont eu tendence à modifier leur facon de traverser le côté profond. Pour rejoindre leur mère, ils ont essayé de longer les côtes de la bordure. En les laissant ramper plusieurs fois les chercheurs ont pu observer clairement, que les petits faisaient preuve de discernement et que environ quatre-vingt pour cent rédirigaient leur comportement, afin de prévenir le risque d' une chute. Les petits plus âgés, lorsqu'ils étaient assis sur la surface du côté profond, avaient là un rythme cardiaque plus rapide qu'au-dessus du côté peu profond. De toute évidence, le comportement des petits enfants, bien qu' ils sont de l'âge différent, a beaucoup en commun. Tout aussi nettement, les petits d'un même âge se comportent différemment sous certains rapports.

Pour les chercheurs il est évident que le sens de la vue se développe très tôt, ce qui signifie que la plupart des petits, malgré des grandes différences d'âge, reconnaissent les cléfs des endroits d'où ils pourraient tomber. D'autre part, il est aussi évident que leurs aptitude à se déplacer et à juger les le conséquences de leurs déplacements diffèrent d'une facon marquée. Il semble que les petits se fient d'abord à leurs yeux dans des situations nouvelles et déroutantes et ce n'est qu'une fois qu' ils peuvent se déplacer et apprennent à juger des conséquences que la signification d'une chute abrupte devient évidente pour les petits enfants. Des études

supplémentaires de ce procèssus pourraient mener aux moyens de minimiser des petits au danger, quand ils commencent à explorer leur milieu de maison.

The Original Swedish Version translated by Behavioural Science Researcher

Viele Eltern, die ihre im Kriechalter befindlichen Kleinkinder sorgfältig beobachtet haben, konnten vermutlich sehen, daß diese anfangs über die unterschiedlichsten Kanten kriechen, ohne sich der Gefahr des Fallens bewußt zu sein.

Eine Gruppe von Wissenschaftlern, interessiert in die Entwicklung von Kindern, hat das Verhalten von Kleinkindern in solchen Situationen näher untersucht. Ziel der Wissenschaftler war es, sich ein besseres Verständnis über die Entwicklung von Fortschritten in Kleinkindern bezüglich ihrer Fähigkeit zur Körperbeherrschung und die Rolle, die die Entwicklung des Sehens in diesem Prozeß spielt, zu verschaffen. Darüber hinaus hofften sie, sich eine Auffassung über die Entwicklung des Urteilvermögens in Kleinkindern im Hinblick auf die Koordination von Sehen und Körperbewegung verschaffen zu können. Schließlich wollten sie herausfinden, auf welche Sinneseindrücke sich das Kleinkind am meisten verläßt.

Da es unethisch gewesen wäre, Kleinkinder naturgetreu gefährlichen Situationen auszusetzen, entsprechend solchen, die zum Beispiel in einem Wohnhaus anzutreffen sind, hatten die Wissenschaftler eine experimentelle Umgebung aufzubauen, die für das Kleinkind die Erfahrung des Fallens simulieren würde. Stellen Sie sich also bitte eine Anordnung vor, die eine Glasplatte hat, und die wie ein 1.80x2.40m großer Tisch aussieht. Die Anordnung, die 1m hoch ist, hat eine ca 20cm hohe Kante, um das Kleinkind vom Herunterfallen zu bewahren, während die Glasplatte durch ein Mittelbrett zweigeteilt worden ist. Unter der einen Hälfte der gläsernen Tischplatte ist ein Tuch, das 0.5cm große Karees hat, direkt gegen die Unterseite des Glases angebracht worden. Die Karees geben der Oberfläche die Erscheinung von Festigkeit und Substanz. Diese Seite wird deswegen die flache Seite genannt. Unter der anderen Hälfte der gläsernen Tischplatte ist ein Stück desselben Tuches, was aber nun 7cm große Karees hat, auf den Boden 1m unterhalb der Glasplatte gelegt worden. Diese Seite, die den Eindruck von Tiefe gibt, wird die tiefe Seite genannt. Um Störungen in der kindlichen Wahrnehmung der beiden Oberflächen zu verringern, ist die tiefe Seite eingehängt und Lampen unterhalb des Mittelbrettes angebracht worden, um die Beleuchtung der beiden Oberflächen auszugleichen.

Im Experiment wurden Mütter eingeladen, mit ihren Kleinkindern an einer Reihe von Aktivitäten, die auf der Tischplatte geschaffen wurden, teilzunehmen. Im Verlauf der Jahre war die Gruppe in der Lage, das Verhalten von mehr als 600 Kleinkindern zu untersuchen, deren Alter zwischen zwei und vierzehn Monaten variierte. Mittels Beobachtungen wurden drei verschiedene Gruppen von Kleinkindern im durchschnittlichen Alter von zwei bis vier Monaten, fünf bis neun Monaten und zehn bis vierzehn Monaten gebildet. Durch das Beobachten dieser Gruppen konnten die Wissenschaftler verschiedene Verhalten unterscheiden. Um mit der jüngsten Gruppe zu beginnen, die Wissenschaftler bemerkten, daß diese Kleinkinder, wenn sie abwechselnd über die flache oder tiefe Seite gebracht wurden, Zeichen der Wahrnehmung der unterschiedlichen Situationen durch physische Reaktionen zeigten. Weil diese Kleinkinder zu klein zum Kriechen waren, senkte eine Person diese langsam bis zu einem Punkt gerade oberhalb der gläsernen Fläche der beiden Seiten. Wenn sie sich in der Nähe der Oberfläche über der flachen Seite befanden, streckten sie typisch ihre Beine und Finger aus, als ob sie erwarteten, sich setzen zu können, was über der tiefen Seite nicht eintraf. Wenn sie anstelle dessen direkt auf die Oberfläche der beiden Seiten gesetzt wurden, sahen sie über der tiefen Seite achtsamer herunter als über der flachen. Darüberhinaus stellten die Wissenschaftler fest, daß diese sehr kleinen Kleinkinder weder weinten, wenn sie auf die Oberfläche der tiefen Seite gesetzt wurden, noch unterschieden sich ihre Herzschläge von Seite zu Seite.

Die Kleinkinder, die ein frühes Kriechalter erreicht hatten, das heißt, Kleinkinder im Alter von fünf bis neun Monaten, verwenden verschiedene strategien zur Bewegung, doch

mußten sie durch ihre Mütter zum Bewegen gelockt werden. Jedes Kleinkind wurde auf das Mittelbrett gesetzt und danach sprach seine Mutter abwechselnd von der tiefen und der flachen Seite zu ihm. Wenn sie sich ihren Müttern von der flachen Seite her näherten, krochen einige über zur tiefen Hälfte und wären, ohne Schutz der Glasfläche, gefallen. In dieser Gruppe wendeten sich viele fort von ihrer Mutter, wenn sie von der tiefen Seite sprach, während andere weinten. Relative viele Kinder krochen diagonal, wenn sie die tiefe Seite überquerten. Einige würden auch das Glas betasten oder lecken. Trotz der Tatsache, daß sie die Gegenwart des Glases fühlten, weigerten sie sich die tiefe Seite zu überqueren. Offensichtlich nahm diese Altersgruppe die Unterschiede der beiden Seiten wahr. Jedoch weniger als die Hälfte der Gruppe konnte die Konsequenzen beurteilen. Die sich spät entwickelnden Kriecher zeigten eine Tendenz, ihren Weg beim Überqueren der tiefen Seite zu verändern. Um ihre Mutter zu erreichen, versuchten sie den Seiten der aufgesetzten Kanten zu folgen.

Indem die Wissenschaftler die Kleinkinder verschiedene Male ihren Weg suchen ließen, konnten sie deutlich beobachten, daß diese Beurteilungen machten, und daß ungefähr achzig Prozent ihr Verhalten änderten, um das Risiko des Fallens zu vermeiden. Die älteren Kleinkinder hatten, wenn sie auf die Oberfläche der tiefen Seite gesetzt wurden, dort schnellere Herzschläge als über der flachen Seite. Offensichtlich hat das Verhalten von Kleinkindern vieles gemeinsam trotz unterschiedlichem Alter. Ebenso deutlich ist es, daß sich Kleinkinder im gleichen Alter in verschiedenen Hinsichten unterschiedlich verhalten.

Für die Wissenschaftler ist es deutlich, daß sich das Sehvermögen sehr früh entwickelt, was bedeutet, daß Kleinkinder, trotz großer Altersunterschiede, Hinweise für Plätze auffassen, wo sie fallen könnten. Auf der anderen Seite ist es aber ebenso deutlich, daß sich die Fähigkeit der Kleinkinder, sich zu bewegen, und die Konsequenzen ihrer Bewegungen zu beurteilen, markant unterscheidet. Es ist unbestreitbar, daß sich Kleinkinder in neuen und verwirrenden Situationen bewegen können, sich aber in erster Linie auf ihre Augen verlassen und erst wenn sie gelernt haben, Konsequenzen zu beurteilen, wird für sie die Bedeutung eines scharfen Abfalles offensichtlich. Weitere Studien dieses Prozeßes könnten zu Hilfsmitteln führen, die verringern, daß Kleinkinder Gefahren ausgesetzt werden, wenn sie beginnen, ihr häusliches Milieu zu untersuchen.

Table 1.

Finalised Supplementation of 15 Blocks of the Double Helix

Block	*Code*	*Strings of Graphemes*	*Literal English*
1	30	Många föräldrar, som noga	Many parents, who carefully
	40	har	have
	50	Många föräldrar, som noga sina småbarn i krypåldern	Many parents, who carefully their infants at the crawling stage
2	30	Många föräldrar, som noga	Many parents, who carefully
	40	observerat	observed
	50	sina småbarn	their infants
	60	i krypåldern	at the crawling stage
3	30	Många föräldrar, som noga	Many parents, who carefully
	40	har	have
	50	antagligen	presumably
4	30	Många föräldrar, som noga	Many parents, who carefully
	40	märkt	noticed
	50	dessa i början över kanter av olika slag utan medvetna om risken	they initally over edges of different kind without aware of the danger
5	30	dessa i början	they initially
	40	kryper	crawl
	50	över kanter av olika slag utan dessa i början medvetna om risken	over edges of different kind without they initially aware of the danger
6	30	dessa i början	they initially
	40	vara	being
	50	medvetna	aware
	60	om risken	of the danger
7	30	dessa i början	they initially
	40	falla	fall
	50	Y	Y
8	30	En grupp forskare	A group of researchers
	40	intresserad	interested
	60	av utvecklingen hos barn	of the development in children
9	30	En grupp forskare	A group of researchers
	40	har	have
	50	En grupp forskare i detalj beteendet ihos småbar i dessa situationer	A group of researchers in detail behaviour of infants in these situations
10	30	En grupp forskare	A group of researchers
	40	utforskat	explored
	60	i detalj beteendet hos småbarn i dessa situationer	in detail behaviour of infants in these situations
11	30	Forskarnas målsattning	The researchers' goal
	40	var	was
	50	Forskarnas målsättning en bättre förståelse av utvecklingen av framsteg hos småbarn	The researchers' goal a better understanding of the development of progress in infants
12	30	Forskarnas målsättning	The researchers' goal
	40	få	gain
	50	en bättre förståelse	a better understanding
	60	av utvecklingen av framsteg hos småbarn	of the development of progress in infants
13	30	Forskarnas målsättning en bättre förståelse av utvecklingen av framsteg hos småbarn	The researchers' goal a better understanding of the development of progress in infants
	40	gäller	concerning
	50	deras förmåga	their ability
14	30	Forskarnas målsättning en bättre förståelse av utvecklingen av framsteg hos småbarn	The researchers' goal a better understanding of development of progress in infants
	40	behärska	master
	50	kroppen och	the body and
	60	av den roll	of the role
15	30	utvecklingen av synen	development of sight
	40	spelar	play
	60	i denna process	in this process